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Surgical Resection of a Reversed Palmaris Longus Muscle Causing Chronic Exertional Compartment Syndrome in a Competitive Swimmer: A Case Report

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Abstract: The palmaris longus is a superficial muscle located on the volar side of the forearm. It usually arises from the medial epicondyle of the humerus and inserts into the palmar aponeurosis of the wrist. However, the palmaris longus is one of the most variable muscles in the human body. The most frequent anatomic variation is complete agenesis, which is found in up to 25% of the population.^{9,12} Other variations include reversed, duplicated, bifid, or hypertrophied palmaris longus muscles, which can be of clinical significance by causing effort-related pain with or without median or ulnar nerve paresthesia.^{1,3,4,11} According to the literature, treatment of these conditions consists of excision of the anomalous muscle, decompressive fasciotomy, median or ulnar nerve release, or a combination of the aforementioned.³ We report a case in which a reversed palmaris longus muscle caused exertional forearm pain without median or ulnar nerve paresthesia in an adolescent competitive swimmer. Treatment consisted of surgical excision of the anomalous muscle, which led to full relief of pain.

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Surgical Resection of a Reversed Palmaris Longus Muscle Causing Chronic Exertional Compartment Syndrome in a Competitive Swimmer

A Case Report

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Keywords: forearm; compartment syndromes; pediatric sports medicine; swimming

The palmaris longus is a superficial muscle located on the volar side of the forearm. It usually arises from the medial epicondyle of the humerus and inserts into the palmar aponeurosis of the wrist. However, the palmaris longus is one of the most variable muscles in the human body. The most frequent anatomic variation is complete agenesis, which is found in up to 25% of the population.^{9,12} Other variations include reversed, duplicated, bifid, or hypertrophied palmaris longus muscles, which can be of clinical significance by causing effort-related pain with or without median or ulnar nerve paresthesia.^{1,3,4,11} According to the literature, treatment of these conditions consists of excision of the anomalous muscle, decompressive fasciotomy, median or ulnar nerve release, or a combination of the aforementioned.³

We report a case in which a reversed palmaris longus muscle caused exertional forearm pain without median or ulnar nerve paresthesia in an adolescent competitive swimmer. Treatment consisted of surgical excision of the anomalous muscle, which led to full relief of pain.

CASE PRESENTATION

A 14-year-old female patient presented with a 1-year history of right volar forearm pain associated with activity. Symptoms were present during her training as a competitive swimmer. Flexion against resistance and maximum extension of the wrist were painful. The patient reported an intermittent elongated swelling on the volar side of her distal forearm with livid discoloration after repetitive movements of the hand or wrist. At rest, the patient was completely free of pain. There was no paresthesia or paresis of the fingers. The patient did not experience a trauma in the past and was otherwise healthy.

On clinical examination, we noted a discrete elongated swelling centrally located on the volar side of the patient's forearm and measuring approximately 6×2 cm. Compression of the swelling was slightly painful. The patient's pain could be reproduced by fully extending the wrist. Maximum flexion was not painful on clinical examination. Both the Tinel sign and Phalen maneuver were negative. Sensory motor testing did not reveal any abnormalities. Measurement of grip strength with the Jamar Hydraulic Hand Dynamometer (Lafayette Instrument Co) showed symmetric results, with a grip strength of 28 kg on the right side and 26 kg on the left side.

During the first consultation, we performed ultrasonographic imaging of the patient's wrist, which revealed a muscle located just above the median nerve and measuring $8 \times 2 \times 1$ cm. Proximally, there was a very thin tendon ending in the flexor pronator muscle group. A proximal palmaris longus muscle could not be identified sonographically (Figure 1). On the contralateral side, we found a

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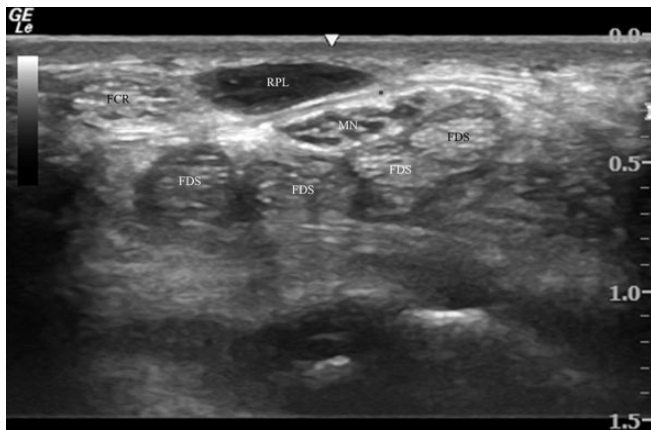


Figure 1. Cross-sectional ultrasonographic image of the patient's wrist revealing the reversed palmaris longus muscle. FCR, flexor carpi radialis muscle; FDS, flexor digitorum superficialis muscle; MN, median nerve; RPL, reversed palmaris longus muscle. *Antebrachial fascia.

normally configured, proximal palmaris longus muscle belly with its distal tendon.

The diagnosis of a symptomatic reversed palmaris longus muscle was established, and occupational therapy with deep friction massages and stretching exercises was initiated. In addition, the wrist was immobilized in a removable splint, and the patient abstained from athletic activities for 2 months.

After 2 months, the initially described symptoms were still present despite adequate patient compliance. Magnetic resonance imaging (MRI) of the right forearm was performed and confirmed the diagnosis of a reversed palmaris longus muscle with its muscle belly next to the tendon of the flexor carpi radialis muscle and insertion at the medial epicondyle of the humerus. A slightly augmented signal was noted in the median nerve in the carpal tunnel, most likely due to a discrete edema. However, no signs of median nerve swelling or external compression were seen (Figure 2).

Because nonoperative therapy was unsuccessful, surgical resection of the reversed palmaris longus muscle was performed. Preoperatively, the dimensions of the muscle were drawn on the patient's forearm by use of ultrasonographic guidance. A skin incision was made along the tendon of the flexor carpi radialis muscle (Figure 3A). Below the subcutaneous tissue appeared a strong fascia, which was incised, revealing the reversed palmaris longus muscle. The muscle was carefully dissected from surrounding tissue (Figure 3B). Proximally, the skin was elevated, which allowed the surgeon to follow the muscle using an endoscopically assisted technique. The thin proximal tendon of the reversed palmaris longus muscle was cut, liberating it from its proximal attachment (Figure 3C). In a next step, the muscle was turned over and carefully released from the underlying fascia. It was then followed distally and cut at the level of the distal tendon, allowing complete resection (Figure 3D). The median nerve was seen through

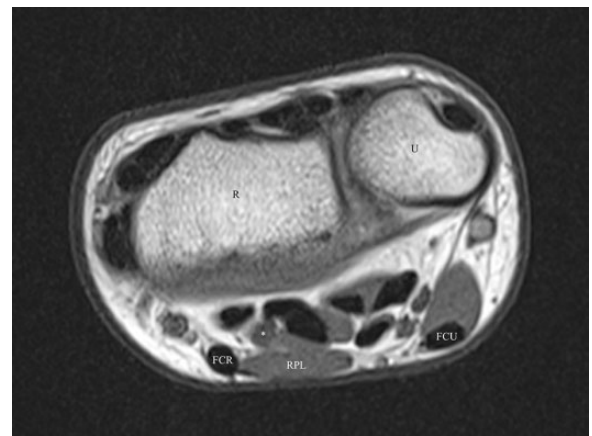


Figure 2. Sagittal T1-weighted magnetic resonance image of the patient's distal forearm. FCR, flexor carpi radialis muscle; FCU, flexor carpi ulnaris muscle; R, radius; RPL, reversed palmaris longus muscle; U, ulna. *Median nerve.

the fascia and appeared to be normal. The wound was closed in the usual manner.

After surgery, the patient's wrist was immobilized in a splint for 2 weeks, followed by functional aftercare. Two months after surgery, we performed a clinical follow-up. At that time, the patient was completely free of pain during her daily activities and could resume her training as a competitive swimmer. The exertional forearm pain did not reappear. Clinical examination was normal, with full range of motion at the level of the wrist and symmetrical strength. Nine months after surgery, the patient was still free of pain and did not have any restrictions during her athletic performances. She was able to resume her training schedule (swimming 6 times per week, strength training 4 times per week, jogging 1 time per week) and returned to competition in national and international tournaments.

DISCUSSION

The differential diagnosis of wrist pain in young athletes is broad. It includes conditions such as tendinopathies due to muscular overuse, radial epiphysitis, or carpal stress fractures in sports with high loading of the wrists.⁶⁻⁸ Muscle anomalies are rare and are often overlooked when establishing the differential diagnosis of exertional forearm pain.

In this case, the presence of a reversed palmaris longus muscle caused effort-related volar forearm pain. Anatomically, the muscle belly of the reversed palmaris longus originated from the palmar aponeurosis, thus adding volume to the flexor compartment of the wrist, which may have led to exertional compartment syndrome because of increased intracompartmental pressure during periods of repeated muscle activity. According to the literature, chronic exertional compartment syndrome of the forearm is a rare condition typically seen in competitive motocross or motorcycle racers, rowers, or baseball pitchers.^{2,5,10,14}

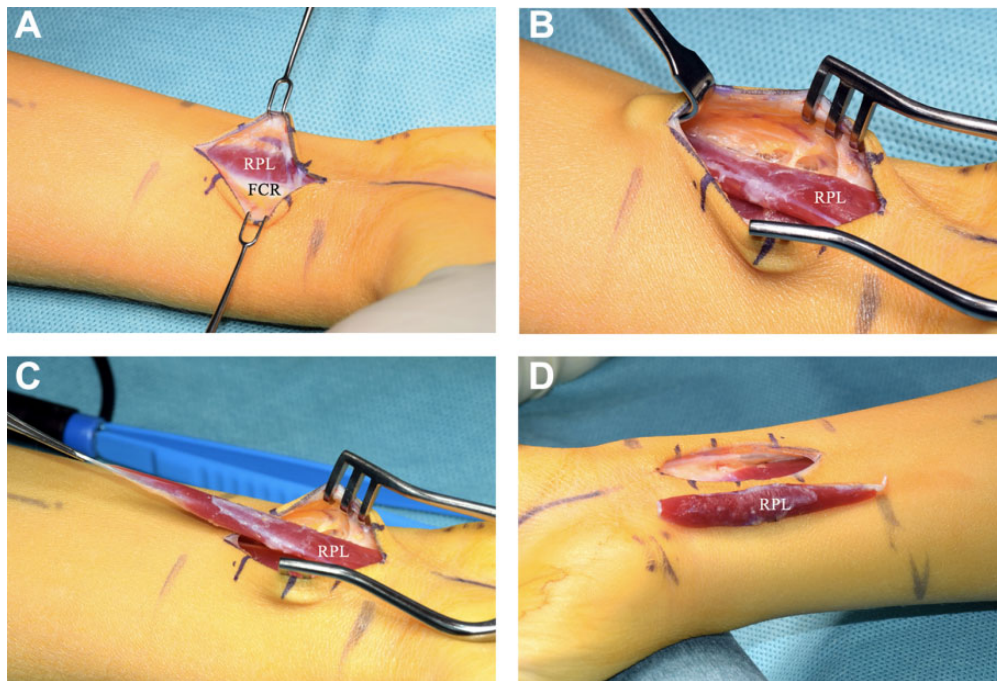


Figure 3. Intraoperative images of the resection of the reversed palmaris longus muscle. (A) Skin incision along the flexor carpi radialis muscle (FCR) (left, proximal; right, distal). (B) Superficial dissection revealing the reversed palmaris longus muscle (RPL) (left, proximal; right, distal). (C) Proximal release of the RPL (left, proximal; right, distal). (D) Resected RPL after distal release (left, distal; right, proximal).

The diagnosis is usually confirmed by intramuscular pressure measurement or postexertional MRI.¹⁵ Pain in this patient, however, was strictly limited to the area of the anomalous muscle and could easily be reproduced during clinical examination. Ultrasonographic imaging allowed us to identify the reversed palmaris longus muscle as the source of pain when symptoms were present. That is why we abstained from performing additional diagnostic tests and based our decision to operate on the combination of clinical examination and ultrasonographic imaging.

If caused by an anomalous palmaris longus muscle, chronic exertional compartment syndrome of the forearm is frequently associated with ulnar or median nerve paresthesia.^{1,3,4,11} The patient in this case report, however, did not have any symptoms of compressive neuropathy. It is possible that the absence of neurological deficits was due to the patient's young age and relatively short history of symptoms, as progressive hypertrophy of the anomalous muscle over time is believed to be the cause of nerve compression and neurological symptoms.¹ The preoperative MRI scans of the patient's forearm showed a slightly altered signal in the median nerve. It is possible that compressive symptoms would have developed if the muscle had not been excised in a timely manner.

Regarding the treatment of chronic exertional compartment syndrome of the forearm, previous studies have suggested that open or minimally invasive fasciotomy and fasciectomy of the forearm flexor compartment are good treatment options if there is no anomalous muscle.^{2,14}

This is not the case if the cause of the exertional forearm pain is an anomalous or hypertrophied palmaris longus muscle. In those situations, surgical excision has proven superior compared with fasciotomy with regard to complete regression of symptoms.^{3,13}

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